



Trends in U.S. Shale Completions

Rob Fulks

Weatherford

Director Strategic Marketing – Pressure Pumping

Houston, Texas, November 2014

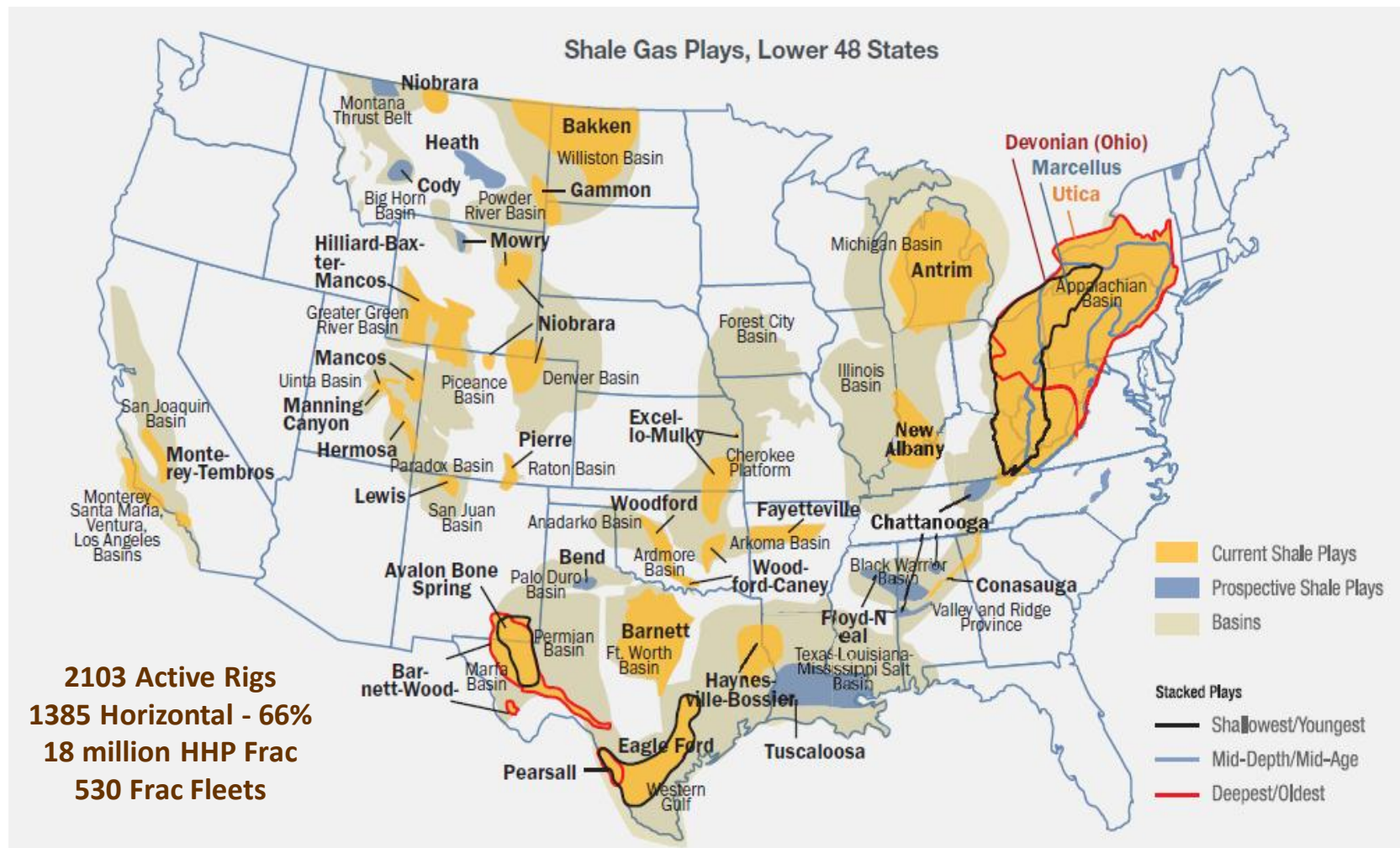
Eagle Ford – Burgos Basin Cross Border Development Conference

Outline:



1. U.S. Oil & Gas Production – Economic Impact of Shale
2. Enabling Technologies: Fracturing, Directional Drilling
3. Shale Completion Trends
4. Water Use in Completions
5. Water Treatment
6. Waterless Alternatives

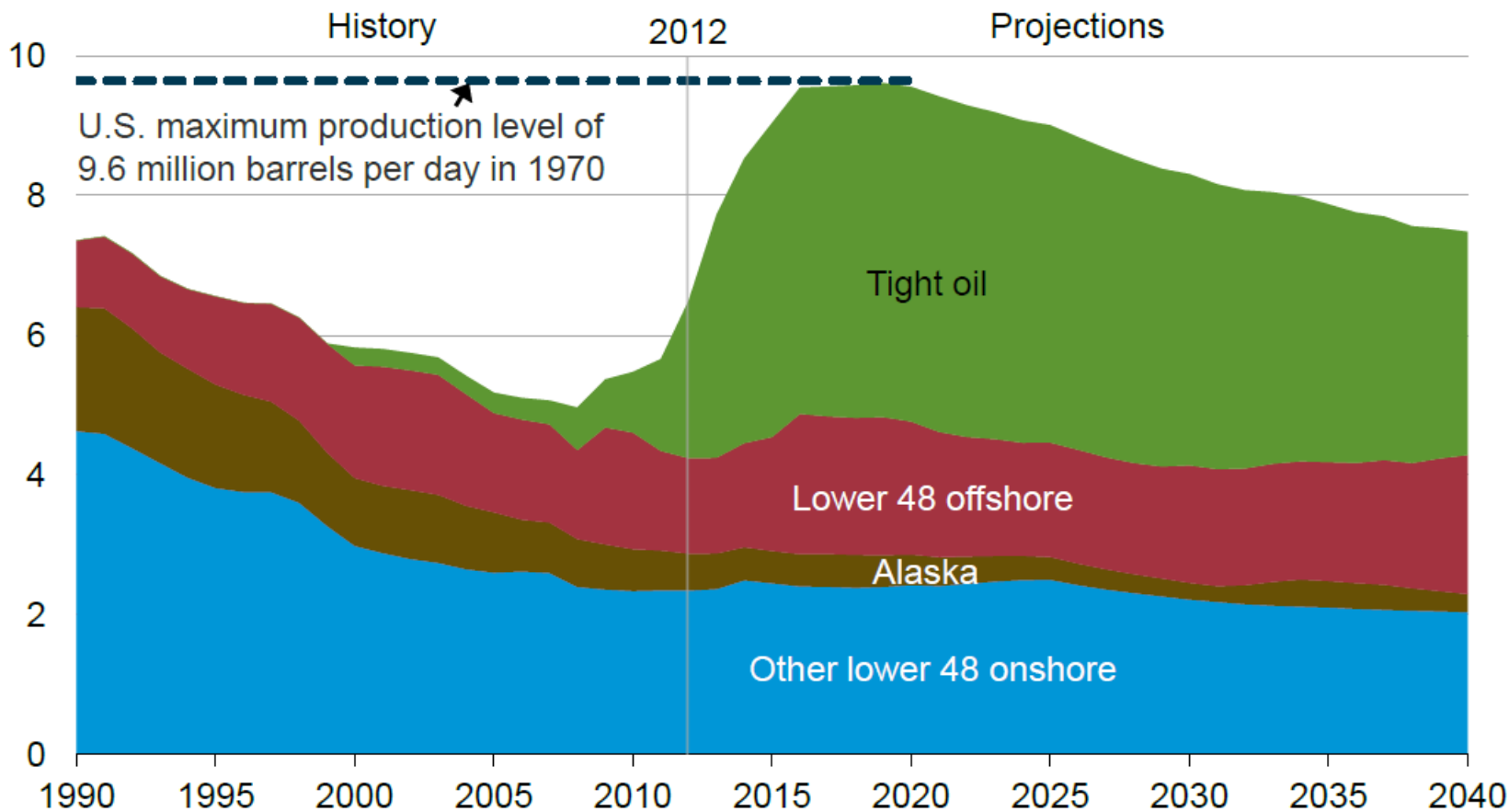
U.S. Shale Oil & Gas Activity Map



U.S. Oil & Gas Shale Production



U.S. crude oil production
million barrels per day



Source: EIA

Global Potential for Shale Oil & Gas

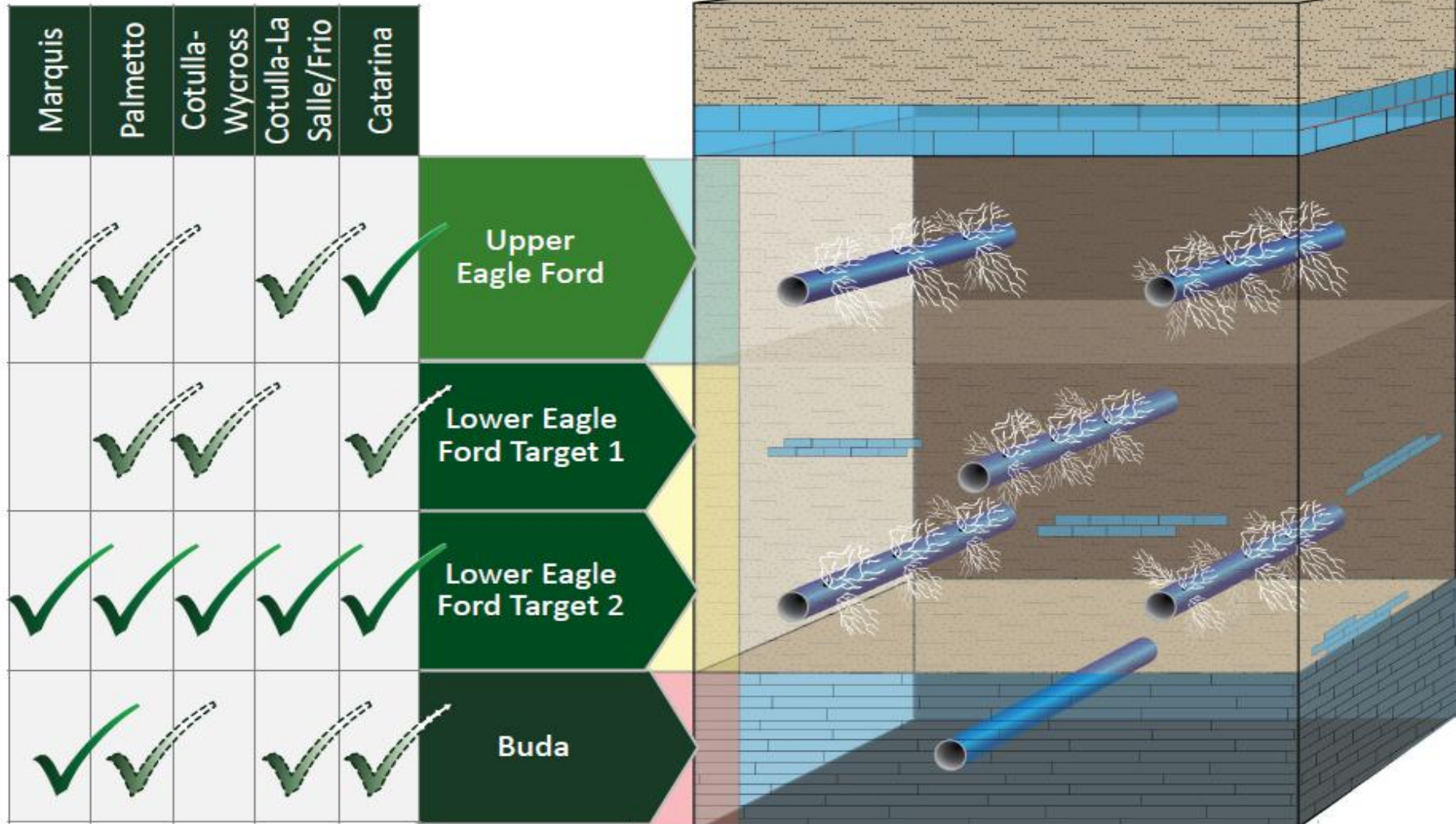


Shale oil		
rank	country	billion barrels
1	Russia	75
2	United States	58
3	China	32
4	Argentina	27
5	Libya	26
6	Venezuela	13
7	Mexico	13
8	Pakistan	9
9	Canada	9
10	Indonesia	8
	World total	345

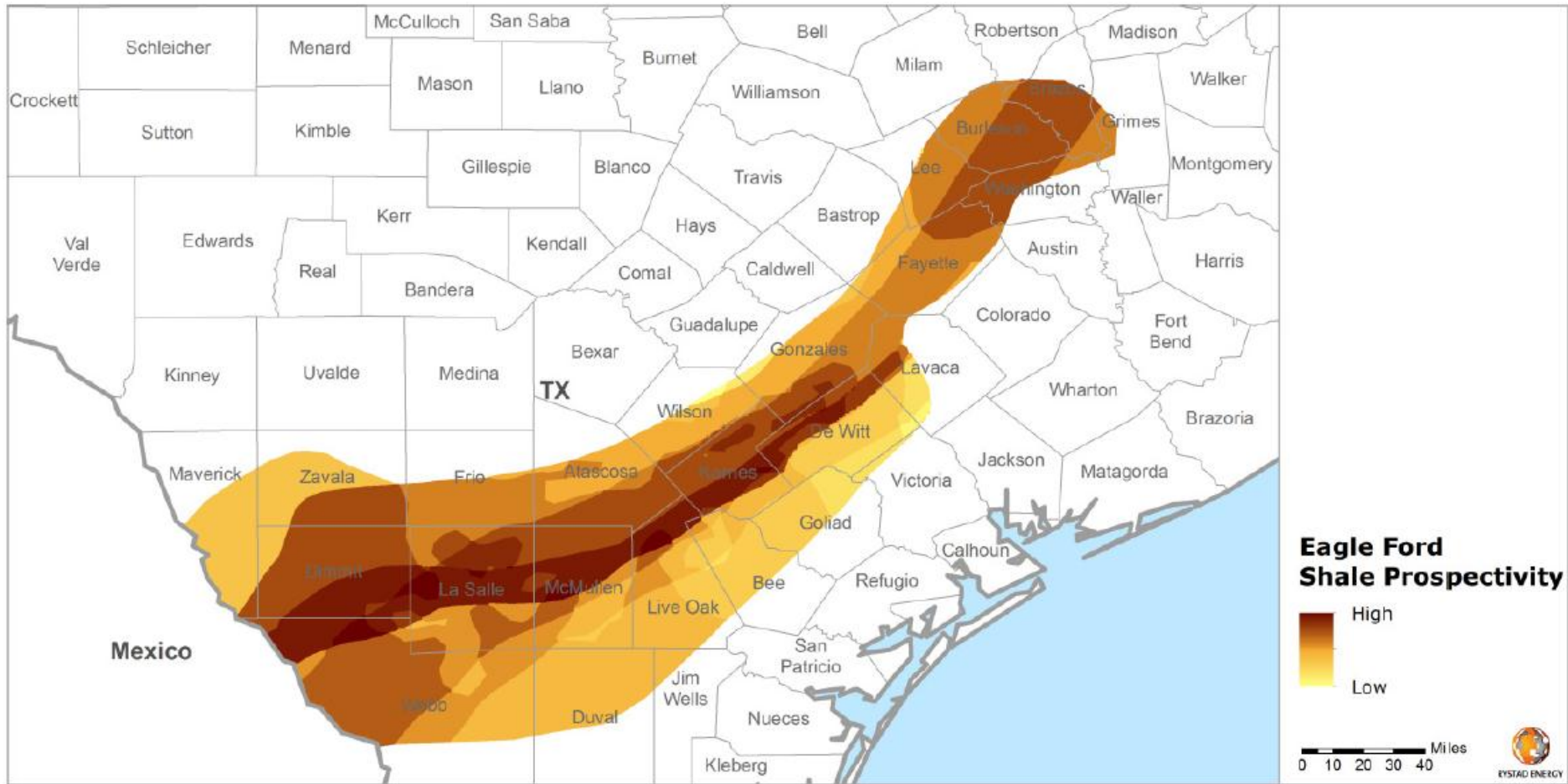
Shale gas		
rank	country	trillion cubic feet
1	China	1,115
2	Argentina	802
3	Algeria	707
4	United States	665
5	Canada	573
6	Mexico	545
7	Australia	437
8	South Africa	390
9	Russia	285
10	Brazil	245
	World total	7,299

Source: EIA

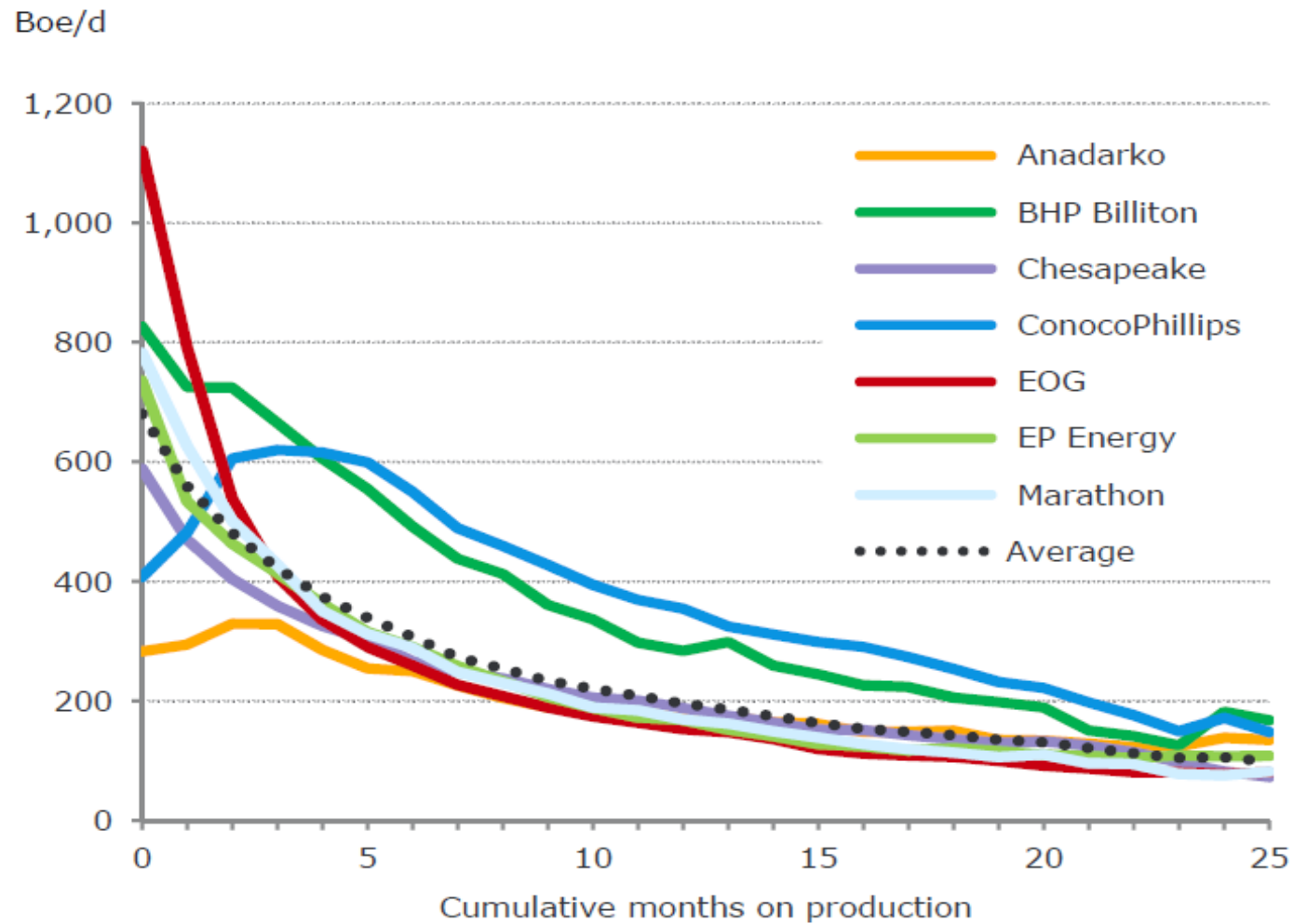
The Eagle Ford Formation



The Eagle Ford Formation in Texas



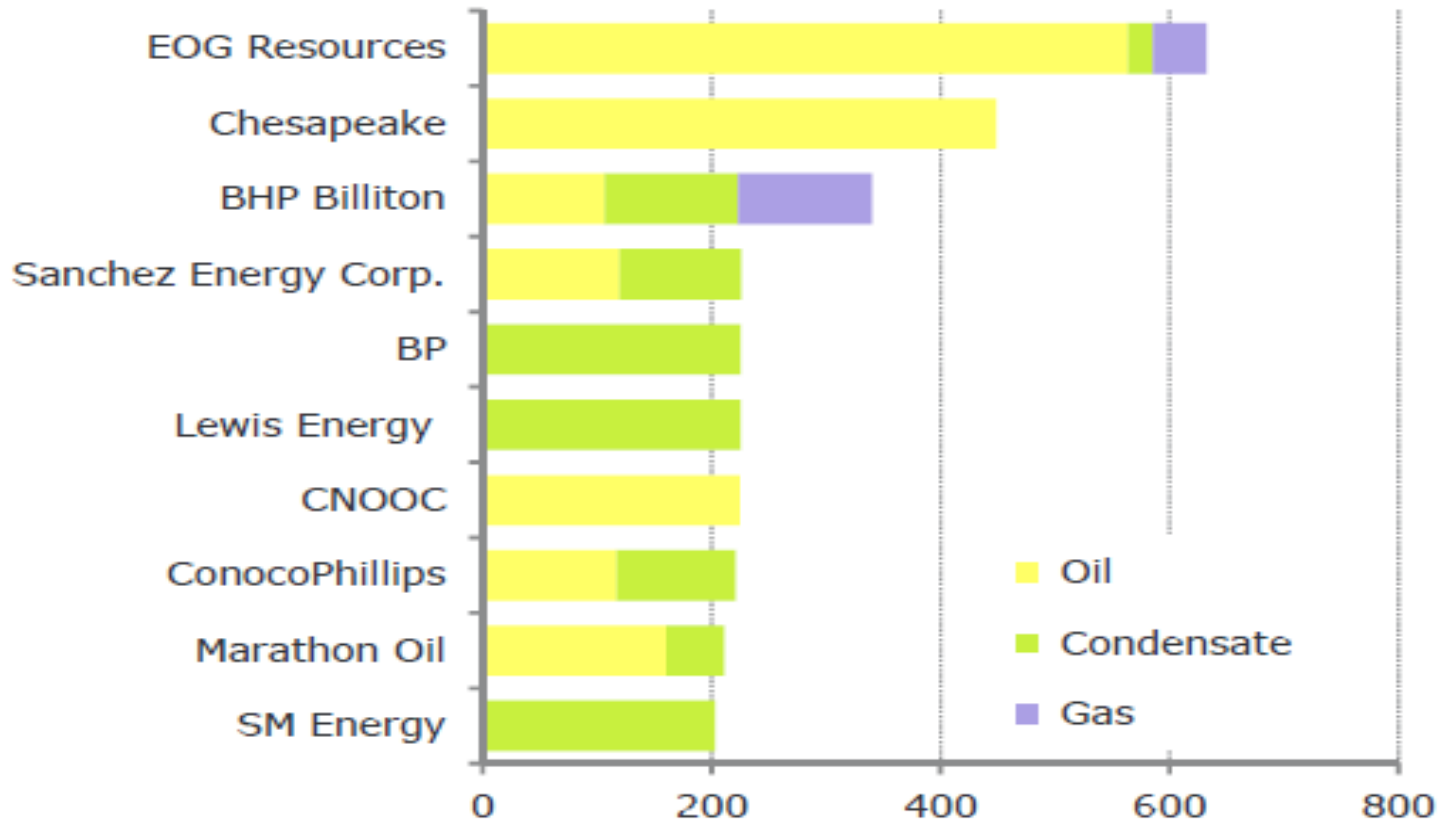
Eagle Ford Average Decline Rates



Oil & Gas Companies in the Eagle Ford



Thousand acres



Typical Eagle Ford Hydraulic Fracturing Site



Trends in U.S. Completions; and Eagle Ford



➤ Lowering Costs by:

- ✓ Zipper Fracturing on pad locations
- ✓ Optimizing proppant logistics (rail, trans-loading, trucking)
- ✓ Fuel substitution (CNG, LPG, line gas for diesel)
- ✓ “Increased use of slickwater fluids

➤ Improving well production by:

- ✓ “Engineered” completions using LWD to adjust plug/packer positions
- ✓ Stacking lateral wellbores to reduce spacing in multi-pay basins
- ✓ “Super-fracs” using significantly higher proppant (sand) amounts
- ✓ Re-fracturing horizontal wells to offset decline

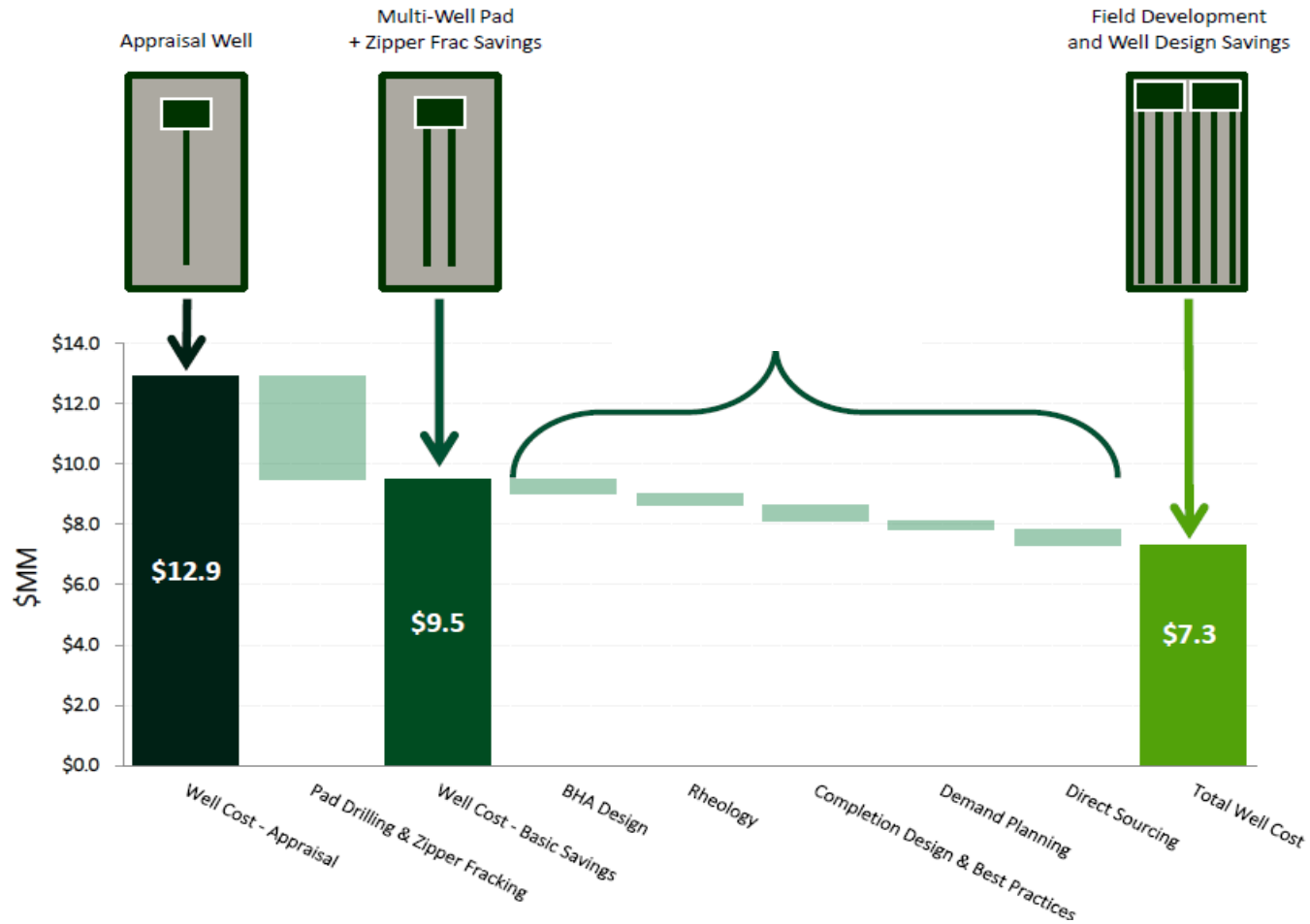
➤ Decreasing Environmental footprint:

- ✓ Limiting freshwater use in fracturing
- ✓ Recycle and use of produced/flowback waters for fracturing
- ✓ Reducing gas in air, sound emissions while fracturing

Lowering Completion Cost



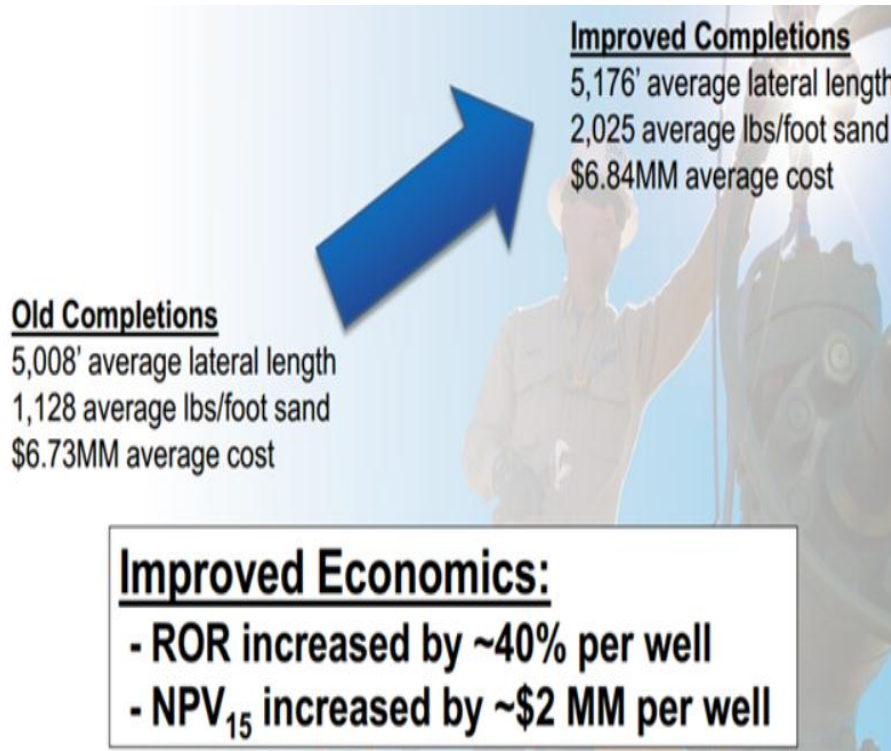
Pads drilling lowers drilling and completion costs



Lowering Completion Cost



Increased sand use improves (EUR/NPV)

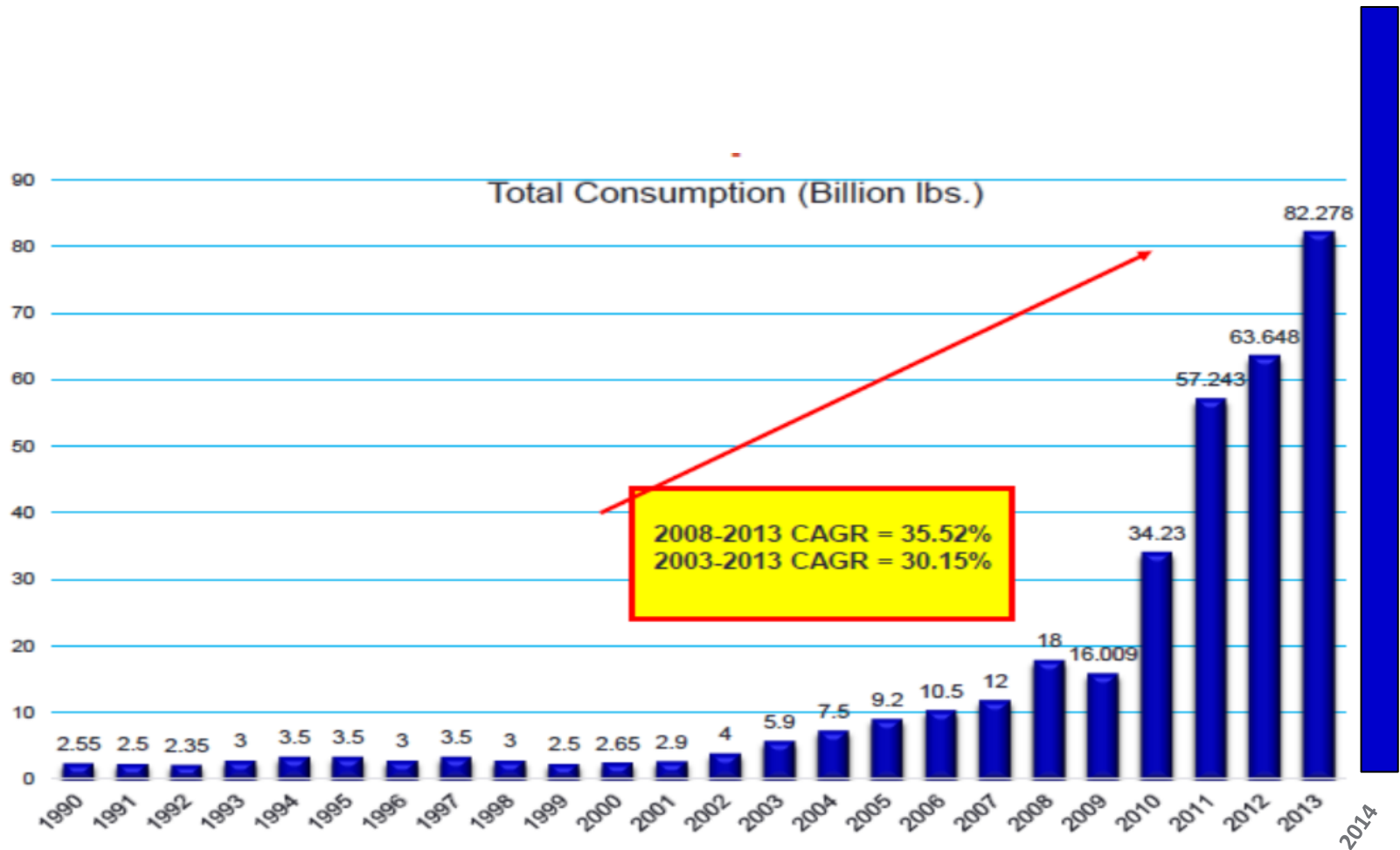


Maximizing sand rail transfer lowers cost



Minimizing sand truck transfer lowers cost

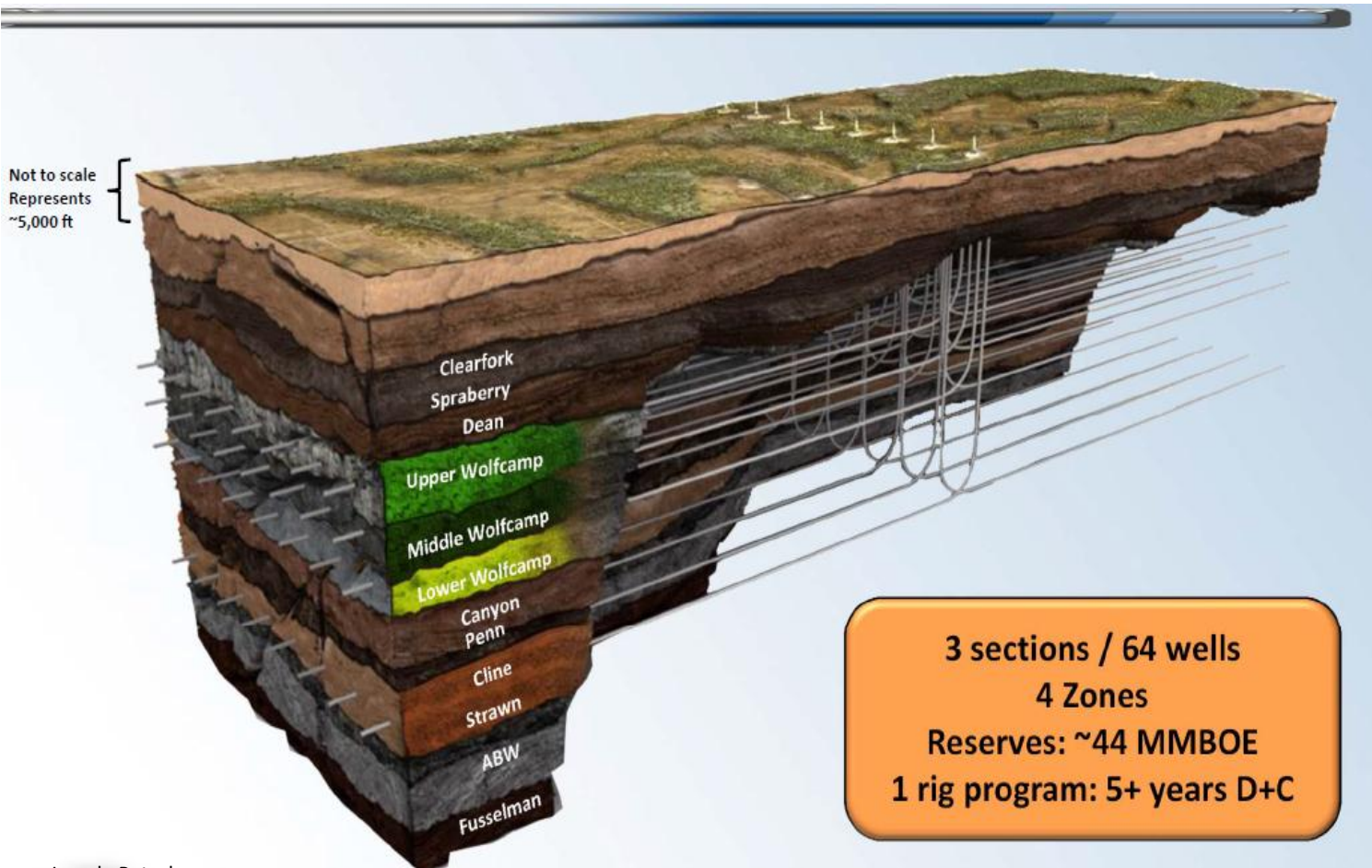
2014 Frac Sand Usage - 50% growth



Lowering Completion Cost

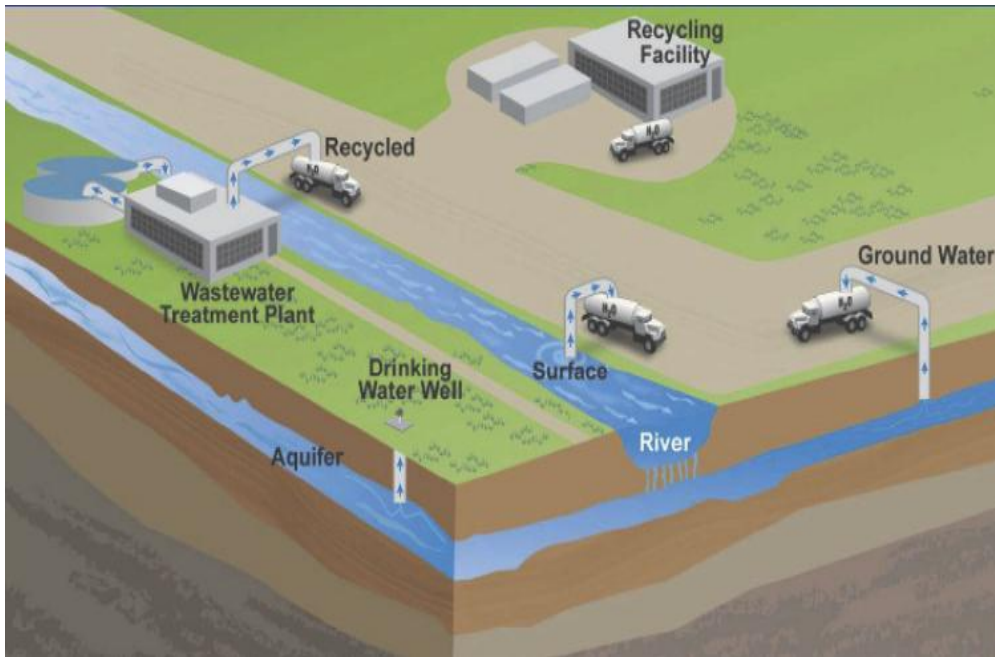


Stacking and staggering horizontal wells lowers cost

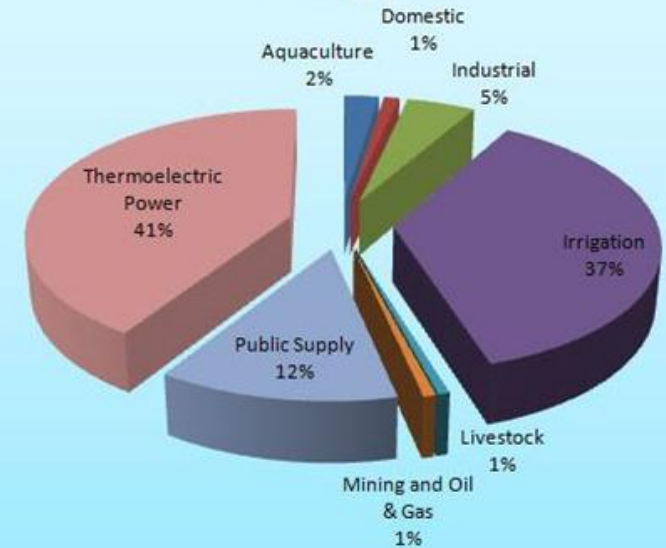


Source: Laredo Petroleum

Lowering Environmental Footprint



Percentage of Water Used by Category



Small in comparison to other water users the oil & gas industry struggles to secure a “social license” to use water on a large scale



Lowering Environmental Footprint



Minimize Trucking
Pumping and Pipelines
Temporary
Integrity
Distance
Permanent network
Link super sources to storage locations
Noise Mitigation

Industry's Approach to Produced Water



- Increase use of produced water in fracturing
- Develop fluids that use high salinity water with minimal treatment OR without any treatment
- Develop chemistries to mitigate the effect of interfering ions
- Lower amount of water disposal
- Reduce trucking cost and number of trucks on roads
- Explore novel approaches to moving sand and water – possibly as slurry



Lowering Environmental Footprint



1. Chemicals



2. Ozone Oxidation

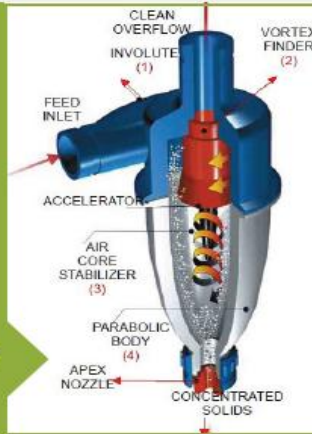


5. Deionization



3. Nano-filtration

4. Hydrocyclones



6. UV

MVR Evaporator, RO, EC...and many more

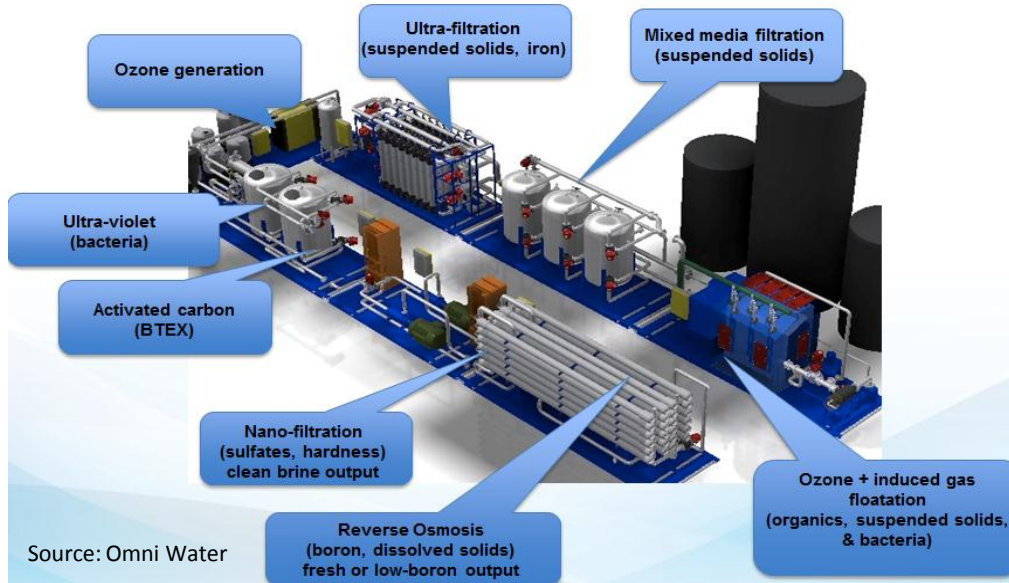
Source: Apache Corporation

Treatment of Produced/Flowback Water



10,000 barrels/day modular unit

2500 barrels/day truck mounted unit



Source: Omni Water



Source: Omni Water

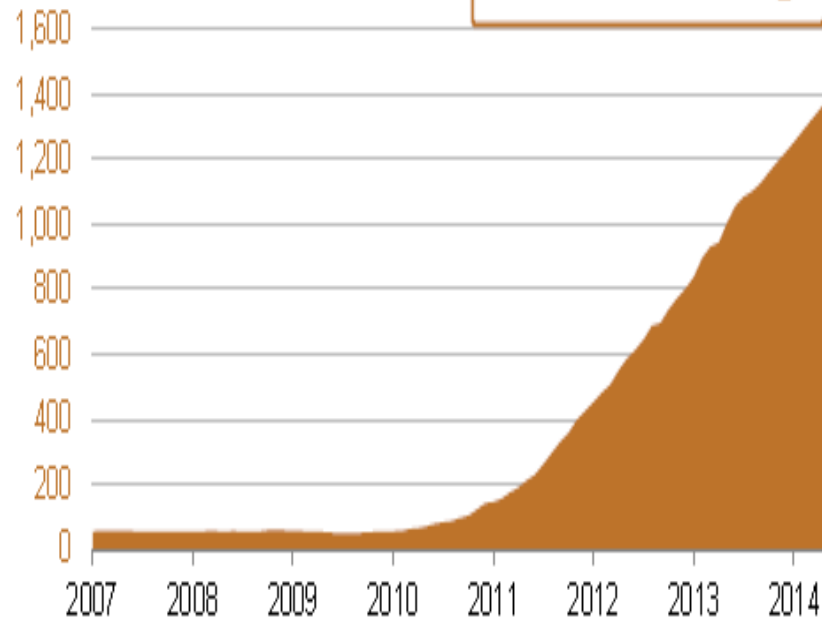
Modular Unit	Function
DAF Module	Clarifies water to 15 micron range
Ozone Module	Oxidizes polymers, kills bacteria
Mixed Media Module	Clarifies water to 5 micron range
Ultra Filtration Module	Clarifies water to sub-micron range
Nano Module	Reduces hardness, sulfates
RO Module	Reduces boron, TDS

Success Can Happen Quickly



Eagle Ford
Oil production

thousand barrels/day

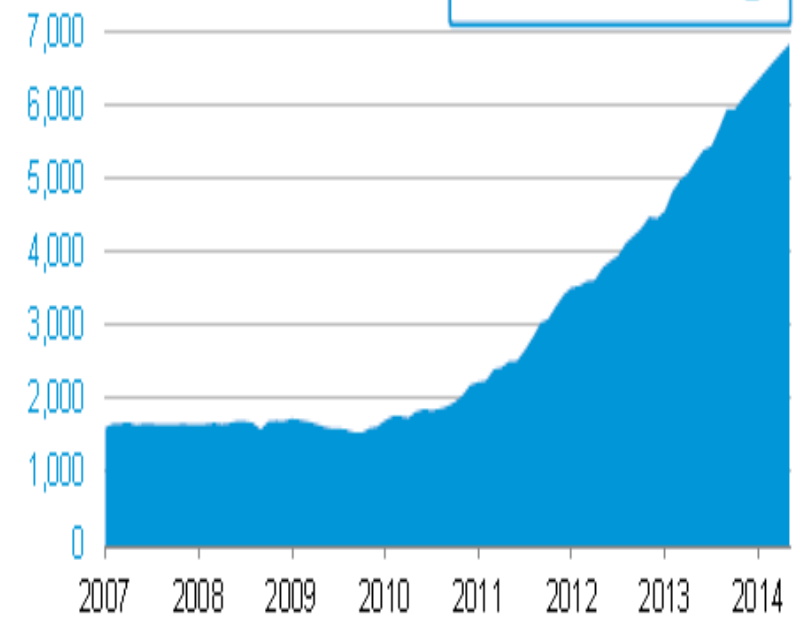


Oil +31
thousand barrels/day
month over month



Eagle Ford
Natural gas production

million cubic feet/day



Gas +115
million cubic feet/day
month over month





Thank You, Gracias